

# METHODS AND CRITERIA FOR AGING INCUBATED EGGS AND NESTLINGS OF THE MOURNING DOVE

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RECENT studies of the Mourning Dove (*Zenaidura macroura*) have indicated the need for better information concerning the migration routes and wintering grounds of the different regional populations in the United States and Canada. Recognition of this need (Kossack, 1955) has resulted in a cooperative program of banding of nestling doves by amateur banders and state and federal workers. Extensive banding operations can be carried out most efficiently if it can be determined in advance when the eggs in various nests will hatch and when the young will be of suitable age for banding. It is hoped that the following descriptive data and photographs will be useful to banders in determining incubation stages of eggs and ages of nestlings. For his excellent work in photographing the nestlings we are indebted to William E. Clark, staff photographer, Illinois Natural History Survey, Urbana.

## AGING INCUBATED EGGS

Since 1950, the writers have used portable egg candler (Hanson, 1954a) and a series of reference photographs (Fig. 1) for determining incubation stages in Mourning Doves. The person who may not wish to construct an egg candler can candle an egg with some success by cradling it between the thumb and forefinger and holding it over a two-cell flashlight. The egg can then be examined under a dark cloth or viewed through a tube of adequate size.

The principal anatomical structures that can be observed in viewing incubated eggs of the Bob-white Quail (*Colinus virginianus*) and certain ducks by transmitted light have been shown and discussed in some detail in an earlier report (Hanson, 1954b). Because of their relatively small size and white, translucent shells, the eggs of Mourning Doves are particularly suitable for candling. Usually greater detail can be seen in candled dove eggs than in those of the above species.

The daily development stages shown in Figure 1 are believed to represent typical stages, although the field investigator may not always be able to see similar details in eggs being candled. The photographs alone may not always suffice at first to permit an investigator to accurately determine the age of each egg examined. In such cases the notes presented on the characteristics of the various stages of development should be helpful, but they will not be needed after experience is gained. Difficulty, however, will generally be ex-

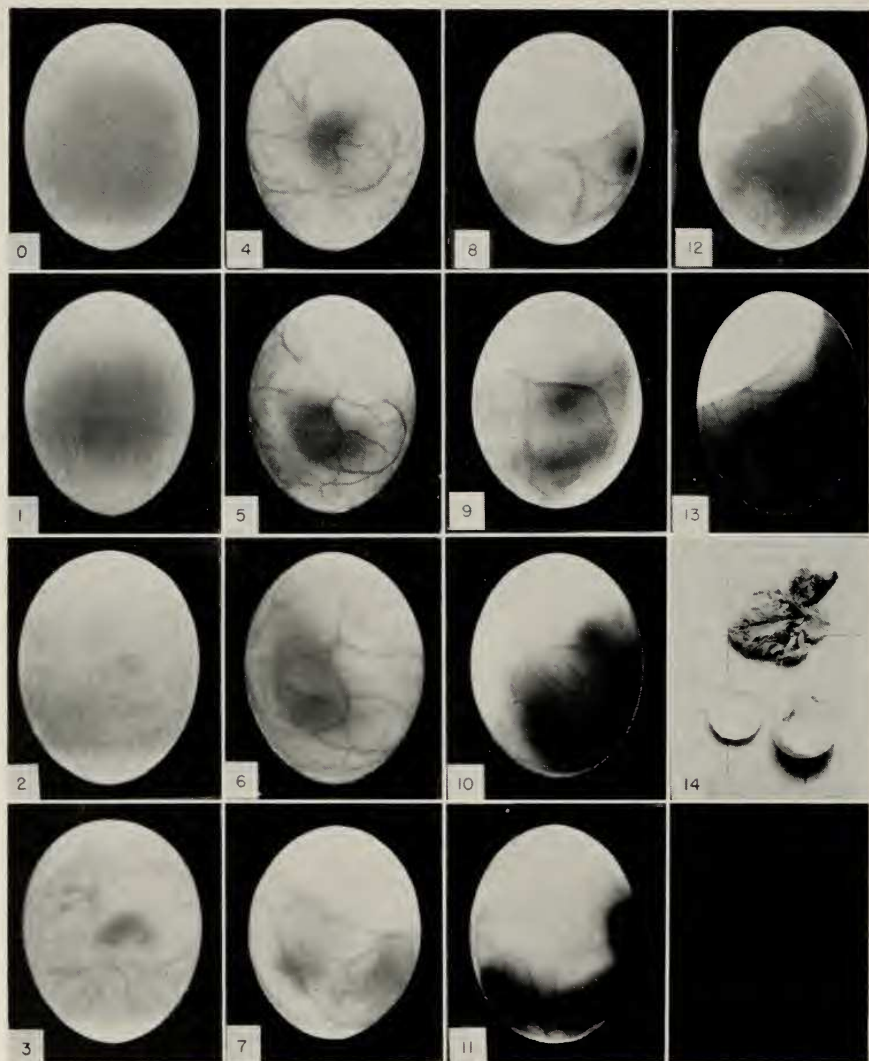


FIG. 1. Incubation stages of Mourning Dove eggs. Days of incubation designated by numerals.

perceived in attempting to make exact age determinations from the seventh through the tenth days of incubation.

There are normally only two eggs in a Mourning Dove clutch and these are usually laid, although not always, a day apart rather than on two successive days. As a result, depending on the incubation habits of the individual pairs, there is normally a difference of about one day in the stages of de-

velopment of the eggs (as well as the hatching, and growth stages of the nestlings). The two eggs also vary in shape and size. Almost invariably the second egg laid is slightly longer and is less oval in appearance than the egg that was laid first (McClure, 1943; Hanson, 1954a). For this reason, should the characters of age not be readily seen in candling, it is important that only one egg be accurately aged. The stage of the second egg relative to the first is a reliable clue as to whether it is a day advanced or behind the first egg in incubation.

#### INCUBATION STAGES

*Fresh egg.*—Egg shell is usually clean and egg has a translucent appearance in normal daylight. Viewed in the candler, the yolk area is yellow to light orange in color and its boundaries poorly defined.

*First day.*—Yolk area is more sharply defined and darker orange in color than in the case of a freshly laid egg. This difference is readily apparent in alternately viewing eggs of these two stages in a complete and normal clutch.

*Second day.*—Embryo is first seen. It appears as a slightly thickened and slightly flexed reddish line 6 to 7 mm. in length. The beating heart is visible at this stage. Distance between anterior vitelline veins is about 10 mm.; *area vasculosa* or yolk sac as delimited by the *sinus terminalis* is about 19 mm. in diameter.

*Third day.*—Embryo is much thickened and more flexed. Beating heart is still visible. Vitelline veins are now a complete network. Difference between this and the second day stage may best be estimated by comparison of the two eggs in a normal clutch.

*Fourth day.*—Embryo is 8 to 9 mm. long and about 3 mm. wide; eye is prominent and easily seen. The *amnion* is about 15 mm. in diameter.

*Fifth day.*—The embryo is not easily seen at this stage due to the fact that it is moving about within the amnion in which it is suspended well below the surface of the egg shell, and is not sufficiently large and opaque unless it lies immediately under the shell. In the latter case, the head and body are apparent as distinct entities. The flexed embryo is about 16 mm. in diameter, and flexes and sways about. The veins of the *allantois*, which has overridden the *yolk sac*, are conspicuous and relatively heavy.

*Sixth day.*—Distance across (diameter) flexed embryo is about 16 mm.; body of embryo is about 10 mm. in length. This stage and the succeeding two are best determined by the diameter length of the embryo relative to the width of the shell and by the relative length of the neck. The neck is not readily seen but its length is indicated by the position of the head and body of the embryo (see stages 5 to 8, Fig. 1).

*Seventh day.*—Flexed embryo is 17 to 18 mm. in length; silhouette of head

about 4 mm. Embryo still flexes and sways to some extent, but from sixth day on becomes gradually less active.

*Eighth day.*—Embryo now lies across the part of the egg distal to the air sac. Movements may be slow or fairly active.

*Ninth day.*—Embryo is much less active than it was during the eighth day. It is not clearly seen in outline, but often appears as a huddled mass in the central area of the egg.

*Tenth day.*—Embryo is now curved in a semicircular position, usually against the shell. Head and neck may move some and kicking movements of the feet may be observed.

*Eleventh day.*—Embryo lies very still, often found stretched out against the shell in the manner shown in Fig. 1, stage 11.

*Twelfth day.*—Embryo immobilized, fills two-thirds of egg distal to air sac; no detailed structures observable.

*Thirteenth day.*—The egg is opaque except for the air sac and a small transverse area in which veins can be seen lying immediately above the area occupied by the embryo. Head of embryo later breaks into air sac.

*Fourteenth day.*—Embryo has hatched, apparently in most cases during the preceding night.

#### NESTLING GROWTH STAGES

Brief notes on the development of nestling Mourning Doves have been presented by Nice (1922) and McClure (1943). The more detailed records presented here, which are based on study of several hundred nestlings, including both captives and wild birds, permit more exact determination of age. In Figures 2 and 3, photographs showing the day by day development of nestling Mourning Doves are presented. Analysis of these records permitted the construction of an "aging gauge," which is shown in Figure 4.

The aging gauge has four scales; the one indicates the average combined length of body and tail of Mourning Dove nestlings of known age; the two other scales are calibrated in millimeters and inches; and the fourth or lower scale is the range in length for birds of a known age. Length and age data are obtained by placing the nestling on the gauge so that the surface of the breast feathers just comes in contact with the end of the vertical stop. The approximate age of the nestling is indicated by the point of terminus of the body—or tail when present.

With the aid of these photographs, the "aging gauge," and descriptive notes given below, the authors had little trouble in determining the age of nestlings through the seventh or eighth day. After the eighth day the problem was more difficult when photographs alone were used, for some of the characters of age were not apparent in the photographs.

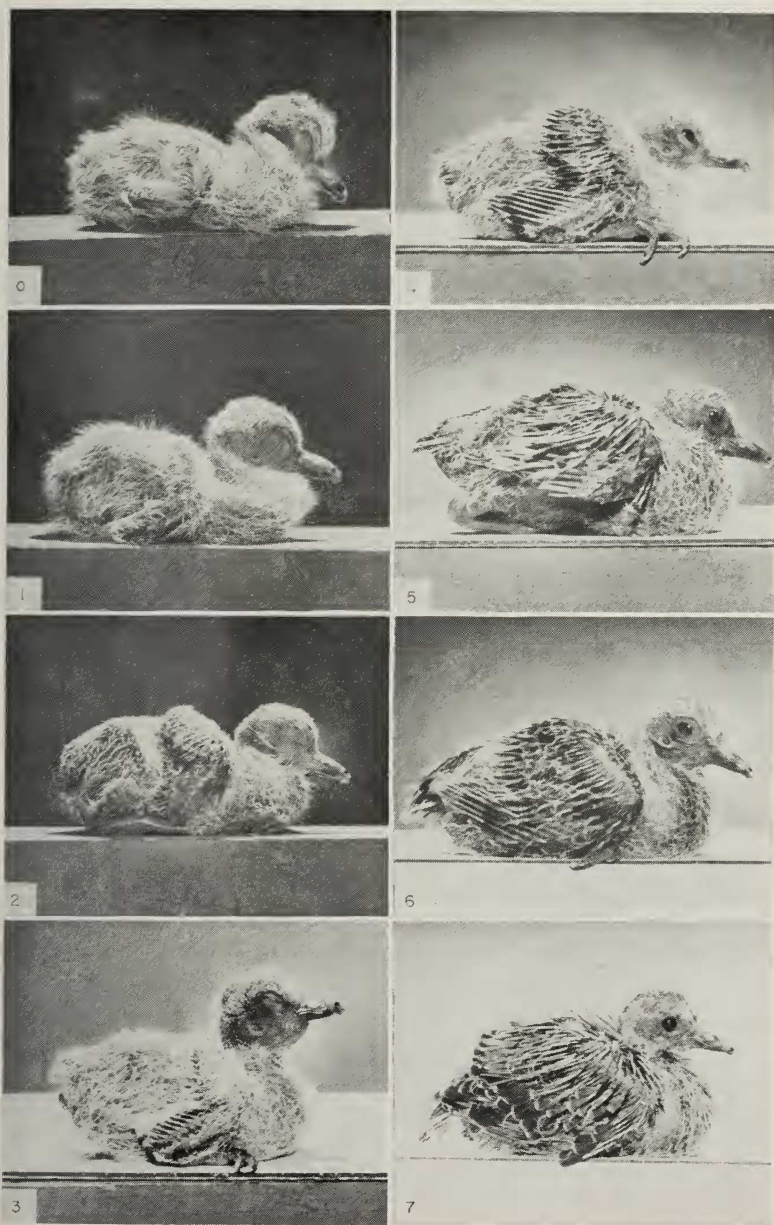


FIG. 2. Growth stages of Mourning Dove nestlings. Age in days designated by numerals.

The tendency in our experience was to overestimate the ages of nestlings nine or more days of age. This factor plus individual variation in size, or stunting, (Fig. 5) emphasizes the need for the combined use of size, plumage and physical characteristics. For example, McClure (1943) noted, as we did (unpublished), that body weight was lower and development was retarded for all nestlings in nests that contained three young as compared with nests that contained two young. Conversely, we have found on several occasions both with wild and captive birds that a single survivor of a clutch may be unusually large and well developed, apparently as a result of an above normal intake of food made possible by lack of competition from a nest mate.

Although it happens infrequently, the younger nestling occasionally grows faster than its nest mate. The writers have measured and marked nest mates when they were two and three days of age. When these nests were revisited and the young were eight and nine days old, the physical development of the younger bird indicated in each case that it was the older. In similar cases in captivity, the younger bird has been observed to be the more aggressive in obtaining food from the parents.

The banding of nestling Mourning Doves at an early age was made possible by the use of "Dalzoflex" elastic adhesive tape (made in England) to hold the bands on the legs (Kossack, 1952). A piece of tape one-half inch wide and sufficiently long to overlap on the band is used. The lower portion of the tape is fastened to the band; the upper portion to the tarsus and to the down feathers on the lower portion of the tibio-tarsus. Half-inch wide plastic adhesive tape has also been used with some success, but it is less desirable than the elastic tape.

In the descriptive notes below, all "lengths" are body length or length of body plus tail (when latter is present) as measured on an aging gauge. Wing measurements are of the straightened and flattened wing, from the bend of the folded wing to its tip. Nestling Mourning Doves have an egg tooth near the tip of both the upper and lower mandibles. For convenience, when both are present, they are referred to as "egg teeth." Reference should be made to Figs. 2 and 3 in reading the descriptions which follow.

*Less than one day old* (Fig. 2 stage 0).—Length 33 (32 to 35) mm.; not much larger than egg from which it was hatched. Bird has difficulty holding head erect. Eyes closed; egg teeth on upper and lower mandible prominent. Down is cream colored. *Key character*.—Small size.

*One day old*.—Length 40 (38 to 41) mm. Increased size of wing is principal change in body characteristics. Primary feathers of wing have not appeared. Eyes closed. Both egg teeth present. *Key character*.—Increased size of wing.

*Two days old*.—Length 49 (45 to 55) mm. Head and body still covered with cream colored down. Skin of wings becoming blue in color. Wing about 19 mm. Primaries just emerging from wing; exposed portion may be 1 to 2 mm. in length. *Key character*.—Emergence of primaries.

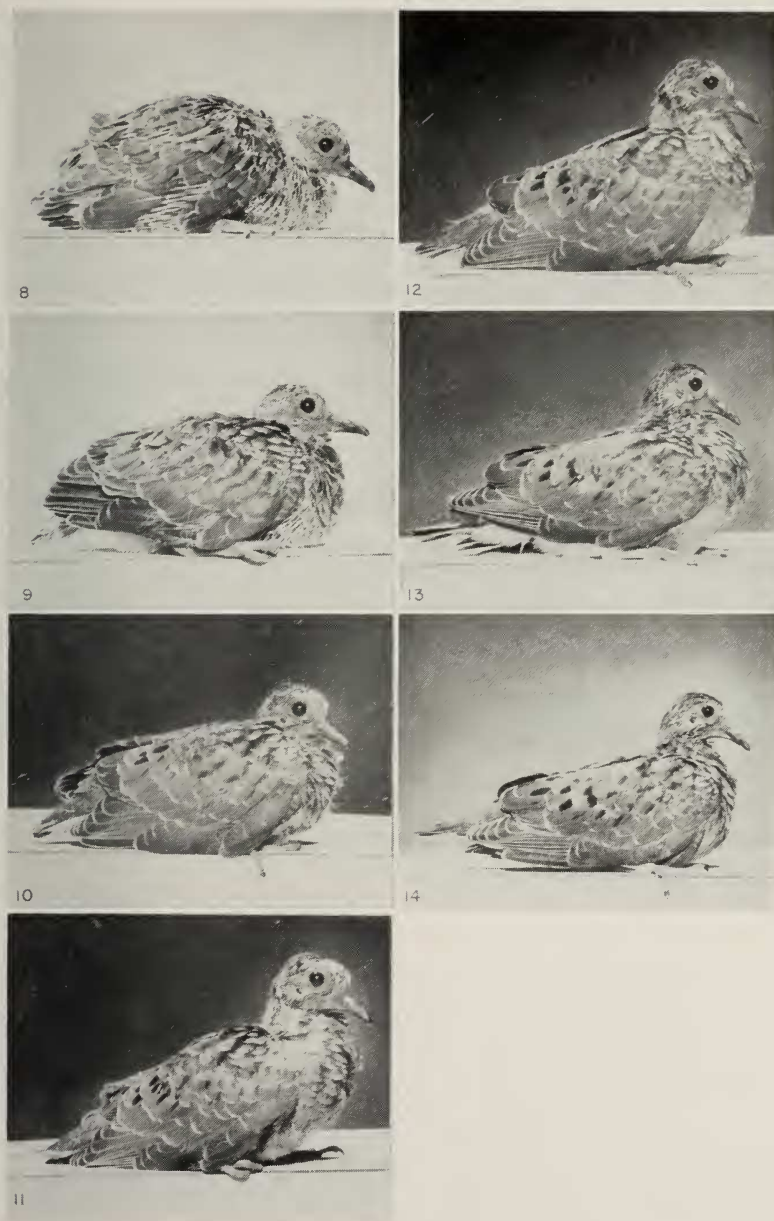


FIG. 3. Growth stages of Mourning Dove nestlings. Age in days designated by numerals. Young doves usually leave the nest when about 12 days old.

*Three days old.*—Length 55 (51 to 66) mm. Body and head still covered with down, but skin is beginning to take on a bluish cast. Wings are dark blue in color. Eyes one-fourth to one-third open. Egg teeth present. Wing about 23 mm. Sheathed primaries 5 (1 to 12) mm. Tail feathers may be just breaking through skin. Tarsus about the width of a no. 3 band (6 mm.) in length. Band will slip readily over foot. (This is the earliest age in which a band may be applied with the aid of tape. Care should be used in applying tape.) *Key character.*—Length of primaries.

*Four days old.*—Length 67 (60 to 77) mm. Body still down-covered. Eyes one-third to one-half open. Egg teeth present. Sheathed primaries 13 (5 to 20) mm. Sheathed tail feathers 3 to 7 mm. Secondary wing feathers have emerged. (Band will still slip over foot. This is the ideal age to begin applying bands with the use of elastic adhesive tape.)—*Key character.*—Length of primaries and tail feathers.

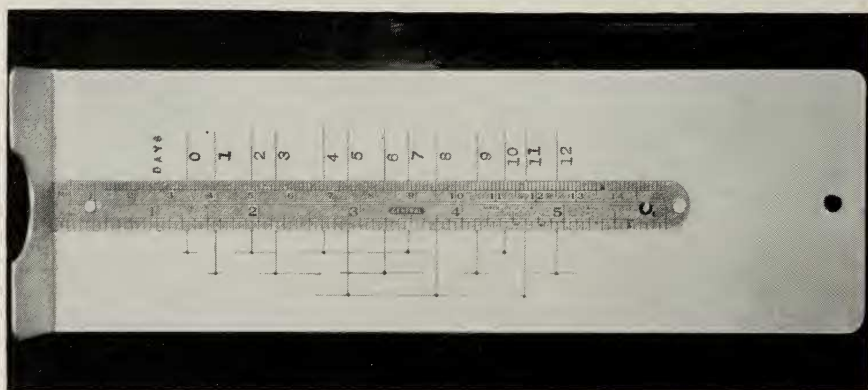


FIG. 4. Gauge for aging nestling Mourning Doves. Average length per day of body, or body plus tail when latter is present, is shown by vertical lines with large numerals. Extremes for these measurements are indicated by the horizontal lines below the center rule.

*Five days old.*—Length 73 (65 to 83) mm. Eyes are about three-quarters open. Egg teeth are present. Pin feathers (sheathed body feathers) just emerging on upper breast. Scapular feathers sheathed. Sheathed feathers present on spinal tract of back. Wing 47 to 50 mm. Tip of wing folded against the body terminates half way between point of juncture of femur and tail feathers with the body (see Fig. 2, stage 5). Sheathed primaries 24 (18 to 29) mm. Tail 6 (3 to 9) mm. Squabs when taken from nest may crawl about slowly. (At this stage the band will slip over the foot; but tape should be used.) *Key character.*—Wing tip terminates between juncture of femur and tail.

*Six days old.*—Length 82 (71 to 92) mm. Eyes fully open. Remnants of egg teeth present. Sheathed feathers on crown of head beginning to emerge from skin. A few feathers of spinal tract on lower back begin to emerge from sheaths. Wing about 59 mm. Wing coverts still sheathed. Primaries 82 (71 to 92) mm. Tip of folded wing extends to base of tail feathers (Fig. 2, stage 6). Tips of primaries in some individuals may be just breaking through sheaths. Tail 13 (10 to 17) mm. Young taken from nest now will crawl fast or may take a defensive attitude with wings raised over back. (In banding at this stage, bands should be opened, and then closed on leg and held in place





FIG. 5. Two nestling Mourning Doves, 12 days of age, showing the contrast in size between a nestling of normal development (left) and one whose growth was stunted (right). Respective weights and measurements: normal nestling, 52 grams, wing 100 mm. and tail 41 mm.; stunted nestling, 32 grams, wing 85 mm. and tail 30 mm. The stunted dove was very weak.

by tape.) *Key character*.—Tip of wing extends to base of tail feathers. Tips of primaries begin to emerge from sheaths.

*Seven days old*.—Length 88 (78 to 94) mm. Egg teeth present but tooth on upper mandible has nearly disappeared. Feathers on crown of head still sheathed. Upper breast feathers and spinal tract feathers partly out of sheaths. Scapular feathers emerging from sheaths. Wing 70 (65 to 73) mm. Primaries 40 (33 to 45) mm. Emerged tips of primaries 8 (3 to 18) mm. Primary wing coverts still in sheaths, but secondary and tertiary coverts becoming free of sheaths. Tail 17 (16 to 21) mm. Nestling will “crawl-run” rapidly. (Band will slip off of leg; use tape.) *Key character*.—Feathering out of tips of primaries and wing coverts.

*Eight days old*.—Length 95 (85 to 102) mm. Egg tooth occasionally still present on upper bill; always present on lower bill. Feathers of spinal tract free of sheaths to a point about midway up back. Breast feathers just beginning to lose sheaths in appreciable numbers. Wing 76 (73 to 80) mm. Primaries 47 (42 to 49) mm. Primaries free of

sheaths 24 (15 to 28) mm. Primary wing coverts breaking free of sheaths. Gaps appear between primaries when wing is spread, since the primaries have not become sufficiently free of the sheaths to present a completely closed wing surface. Tail 26 (23 to 30) mm. (Band will slip off of leg; use tape.) *Key character*.—Appearance of gaps among wing feathers.

*Nine days old*.—Length 105 (102 to 108) mm. Egg tooth absent from upper mandible, may still be prominent on lower mandible. Small patch of crown feathers free of sheaths. Upper portion of breast now fairly well feathered out. Ventral tract feathers of belly losing sheaths. Wing 83 (78 to 87) mm. Primaries about 54 mm., free of sheaths for over half their length. Primary feathers of wing now present a continuous surface when spread. Tail about 30 mm. Nestling may leave nest if alarmed. (Occasionally it will be necessary to use tape in banding.) *Key character*.—Feathering out of crown and closing of wing surface.

*Ten days old*.—Length 112 (108 to 115) mm. Feathers of head (capital) and back (spinal) tracts out of sheaths, but feathers of lower back of neck remain sheathed. Auricular feathers becoming free of sheaths. Wing 89 (85 to 94) mm. Tail 37 (31 to 42) mm. (After the ninth day the young are easily frightened and may leave the nest when disturbed.) *Key character*.—It is doubtful whether the age of nestlings can be judged with any certainty beyond the 9th day. Probably the presence of sheathed feathers on the back of the neck along with the wing and tail measurements are the best indicators of this age.

*Eleven days old*.—Length about 116 mm. Feathers of ventral tract of belly area becoming unsheathed. Wing about 92 mm.; tail 40 mm. *Key character*.—Unsheathing of belly feathers.

*Twelve to 14 days old*.—Length about 121 mm. Wing about 99 mm. As McClure (1943:388) states, feather development from the twelfth to the fourteenth days "is that of a refinement, with the completion of feather coverage under the wings and belly and with the development of the fine feather bloom." (From the ninth day on the young may leave the nest when disturbed.)

#### SUMMARY

Methods and criteria for aging incubated eggs and nestlings of the Mourning Dove are described. With the use of a portable egg candler and the aid of photographs of incubated eggs taken by means of transmitted light, incubation stages, except for 7 through 10 days, can usually be determined with accuracy. Descriptive notes are also furnished as an additional aid in determining incubation stages.

Nestling Mourning Doves were aged by comparing them with photographs of nestlings of known age. An aging gauge showing the average and range of combined body and tail length also proved helpful. Descriptive notes that emphasize the "key characters" of age at consecutive days of growth are presented. The use of elastic adhesive tape in banding nestling doves is also described. Studies of captives and doves in the wild revealed that stunting in nestlings sometimes occurs. Also in some cases, the second hatched nestling may outgrow the first hatched nestling because of the former's more aggressive feeding behavior.

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